VIDEO ARTICLE

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Architectured Hybrid Materials Produced by Severe Plastic Deformation: Theory and Industrial Applications

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Abstract

Significant enhancement of the properties may be achieved through hybrid materials produced by newly emerging techniques of shear mixing. It was shown that properties obtained by severe plastic co-deformation of dissimilar metallic materials are far outside of expected properties of composite materials due to several physical phenomena observed, such as extension of solid solubility in immiscible metals, formation of non-equilibrium phases and reduction of grain size to range of 10-20 nm near interface. This level of nanostructuring that is accessible in hybrid materials is shown to be unreachable in single constituent materials. The idea of manufacturing material hybrids with simultaneous nanostructuring by SPD to reach new level of properties is quite appealing. The architecture of hybrid materials is based not only on design of constituents and their volume fraction but optimisation of the width and composition of interface zone. Moreover, the understanding of physical mechanisms involved in interface formation and triggered by severe shear deformation under hydrostatic pressure is crucial for architecture of hybrid materials with enhanced properties.
A review of some cases on the hybrid materials produced by different SPD methods and targeting specific industrial applications will be presented in this talk.

Biography of Presenting Author

Rimma Lapovok is currently the Professor and Marie Skłodowska Curie Fellow in Department of Materials Science and Engineering of Israel Institute of Technology (Technion, Israel). She is also the Associate Professor (Research) in Institute for Frontier Materials, Deakin University (Australia). From 2000, Rimma Lapovok worked fifteen years in Monash University (Australia) and was a winner of 'Lady Davies Trust' fellowship in 2014. Rimma Lapovok has graduated in 'Solid Mechanics' and completed her PhD in 'Metal Working Processes' in Russia. Since 1991 she lived and worked in Australia where she has pioneered the Severe Plastic Deformation (SPD) research. She has designed several novel rigs for production of ultrafine grained materials, including ECAP machine with back-pressure, High Pressure Tube Shearing, Hydro-ECAP, SPD processes with rotational shear plane and others. The novel approach in these processes is based on fundamentals of mechanics of materials. In the last

seven years, Rimma Lapovok has made a considerable contribution to the area of Hybrid Materials by SPD processing. Development of methods to improve simultaneously strength and electrical conductivity are especially relevant to advanced energy materials. She has published about 201 papers on ultrafine grained materials and SPD processing and her H-factor is 36.

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